Hubble Science Briefing

Tracing the Lifecycle of Planetary Systems around stars (slightly) more massive than the Sun

John Debes
Unchanging Heavens?
How do we study populations of stars?
We are but Mayflies of the Milky Way...
Stellar and Planetary Birth

AB Aurigae Disk
Hubble Space Telescope • STIS

University of Hawaii

Diameter of Pluto’s Orbit

HSB--John Debes
HD 100546

Ardila et al., 2007
Disk structures, planets

Dust segregation

CO, H$_2$O, dust

Menu et al., 2014
Planetary Adolescence

NASA’s IRAS discovers the “Fabulous Four”, and launches the characterization of dusty stars
Three of the Fabulous Four

All A-type stars, two known to host planetary mass objects
β Pictoris

Smith & Terrile (1984)
β Pictoris
β Pictoris b

Nielsen et al. (2014)

Snellen et al. (2014)
β Pictoris b—transiting planet?

Lecavelier des Etangs et al. (1997)
Planet Crashes at HD 172555

Lisse et al. (2009)
HR 4796A—Mysterious Dust

Wahhaj et al. (2014)
Debes et al. (2008)
HR 8799

November 1, 2009 L’-band
HR 8799

HR 8799bcde

Solar System

20 AU

0.5 arcsec
Middle Age Planets

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‘Retired’ planetary systems

Bonsor et al. (2013)
‘Retired’ planetary systems
The ultimate retirement
A planetary system’s swan song
Stellar Brightness

Wavelength (μm)

Data from Reach et al. (2005)
White dwarf dust looks like asteroids

Xu et al. (2014)
Agol (2011)
Take Home Points

• Dust traces the lives of planets from birth until death
• Stars more massive than the sun have been a goldmine of information about the diverse and amazing process of planet formation
• While we know much, the process of planet formation is still quite mysterious and surprising—leading us into exciting territory!